

## 1    CLAIMS

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3    1. Apparatus for the stimulation of molecular  
4    resonance by the application of very low intensity  
5    electromagnetic radiation, comprising a laser of  
6    multiple line cavity resonance consisting of a laser  
7    diode with a collimated or near collimated beam, said  
8    beam being passed through a phase cancellation  
9    optical element having the characteristic of  
10   cancelling several of the central lines of the laser  
11   frequency while leaving the higher and lower  
12   frequencies generally uncancelled such that the beat  
13   frequency of the passed frequencies forms a pattern  
14   of interference of constructive and destructive nodes  
15   in which the diameter of the beam is set to be a  
16   sufficiently low multiple of the wavelength of the  
17   beat frequency to allow a substantial Fresnel zone to  
18   be apparent in the beam and in which an aperture is  
19   provided to select a portion of the Fresnel zone  
20   wherein a substantial majority of destructive nodes  
21   are apparent relative to the constructive nodes and  
22   in which means are provided to modulate the laser  
23   frequency.

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25    2. Apparatus as claimed in Claim 1, wherein the  
26   laser frequency is varied by adjusting the current on  
27   a laser diode.

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1 3. Apparatus as claimed in Claim 1 or Claim 2  
2 wherein the laser frequency is varied by physical  
3 alteration of a secondary cavity such as a crystal  
4 provided to double the primary frequency.

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6 4. Apparatus as claimed in any of the preceding  
7 Claims wherein the modulation frequency is a harmonic  
8 of the beat frequency.

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10 5. Apparatus as claimed in any of the preceding  
11 Claims wherein the modulation frequency is a harmonic  
12 of a specific molecular resonance.

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14 6. Apparatus as claimed in any of the preceding  
15 Claims wherein the aperture or angle of the beam  
16 passage through the cancellation device may be varied  
17 consequently varying the beat frequency.

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19 7. Apparatus as claimed in any of the preceding  
20 Claims wherein the selected portion of the beam may  
21 be varied to alter the balance between constructive  
22 and destructive nodes.

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24 8. Apparatus as claimed in any of the preceding  
25 Claims wherein the means for modulating the laser  
26 frequency is the consequential mode transition of a  
27 laser diode in pulse mode.

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2 9. Apparatus as claimed in Claim 8 where the laser  
3 diode mode is held within bounds by reflection from a  
4 Bragg grating so that the modulation of the Fresnel  
5 zone nodes is a consequence of the Fourier transform  
6 of the pulse.

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8 10. A method of stimulation of molecular resonance  
9 by the application of very low intensity  
10 electromagnetic radiation modulated at resonant  
11 frequencies of molecules of high Q by use of a laser  
12 of multiple line cavity resonance consisting of a  
13 laser diode with a collimated or near collimated  
14 beam, said beam being passed through a phase  
15 cancellation optical element said cancellation device  
16 having the characteristic of cancelling several of  
17 the central lines of the laser frequency while  
18 leaving the higher and lower frequencies generally .  
19 uncancelled such that the beat frequency of the  
20 passed frequencies forms a pattern of interference of  
21 constructive and destructive nodes, in which method  
22 the diameter of the beam is set to be a sufficiently  
23 low multiple of the wavelength of the beat frequency  
24 to allow a substantial Fresnel zone to be apparent in  
25 the beam and in which an aperture is provided to  
26 select a portion of the Fresnel zone wherein a  
27 substantial majority of destructive nodes are  
28 apparent relative to the constructive nodes and in  
29 which means are provided to modulate the laser  
30 frequency.

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2 11. Apparatus for the production of sub picosecond  
3 light pulses, the apparatus comprising a laser  
4 producing a collimated or near collimated beam, a  
5 phase cancellation optical element through which said  
6 beam is passed, said phase cancellation optical  
7 element being formed by the series combination of a  
8 first diffraction grating, a refractive element and a  
9 second diffraction grating, whereby a pattern of  
10 interference of constructive and destructive nodes is  
11 formed in which the diameter of the beam is set to be  
12 a sufficiently low multiple of the wavelength of the  
13 beat frequency to allow a substantial Fresnel zone to  
14 be apparent in the beam, the apparatus further  
15 including means for pulsing the laser with short  
16 duration pulses to produce for each pulse an isolated  
17 traverse through the frequency mode of the laser.

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